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Book of Abstracts

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FACULTY OF ENGINEERING AND ARCHITECTURE

DANA BCCA ROBOVISION DENYS VINÇOTTE CNH INDUSTRIAL

11. Ricardo Cajo, Thoa Mac Thi, Cosmin Copot, Douglas Plaza, Robain De Keyser & Clara Ionescu

Drones Formation Control for Emergency Equipment and Medicines Delivery Based on Optimal Controllers

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In this work, a fractional order proportionalderivative (FOPD) control approach is applied to multiple unmanned aerial vehicles (UAVs) based on leader-follower formation for tackling an emergency health case. The controller parameters are tuning based on a multi-objective particle swarm optimization (MOPSO) algorithm with an accelerated update methodology. Its performance is compared against an integer order proportional-derivative (IOPD) control. Finally, the global path planning for the UAVs swarm is found using the Dijkstra's algorithm with quintic polynomial trajectory. This provides an optimal global paths in terms of the path's length and smoothness, considering the physical system dimension and constraints of acceleration and velocity average of the UAV. The simulation tests using the virtual environment demonstrate the proposed controller outperforms the IOPD control.

FACULTY OF ENGINEERING AND ARCHITECTURE

DEPARTMENT OF ELECTRICAL ENERGY, METALS, MECHANICAL CONSTRUCTION & SYSTEMS

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DRONES FORMATION CONTROL FOR EMERGENCY EQUIPMENT AND MEDICINES DELIVERY BASED ON OPTIMAL CONTROLLERS

1.- Problem statement

- Timely delivery
- Low payload
- High cost
- Adverse weather conditions

Solutions:

- Commercial drones
- Cooperative formation
- Robust controller

2.- Goal

- Economic and efficient transportation emergency equipment and medicines delivery
  - Timely delivery, commercial drones, increase payload

Solution:

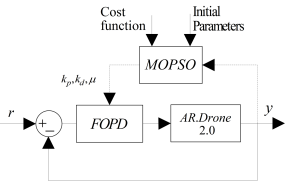
- Robust controller
  - Fractional order proportional derivative (FOPD) control
- Cooperative formation
  - Leader-follower approach

3.- Tuning Methodology

- Multi-objective particle swarm optimization (MOPSO) algorithm

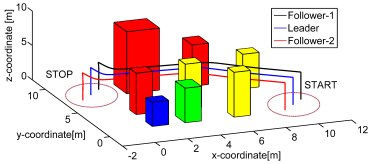
Cost Function:

- Performance criteria
  - settling times
  - overshoot
  - steady-state error



4.- Simulation Results

a)



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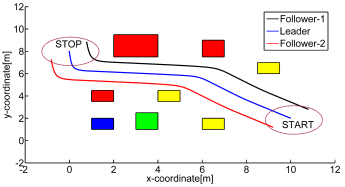

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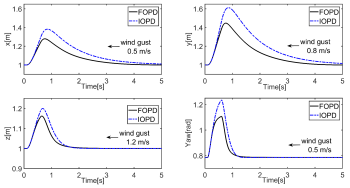

5.- Conclusions

- Simulation tests using the virtual environment demonstrate the proposed controller outperforms the IOPD control.
- FOPD has a better trajectory tracking performance and disturbance rejection during translational movements over x, y, altitude and angle/orientation control.

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